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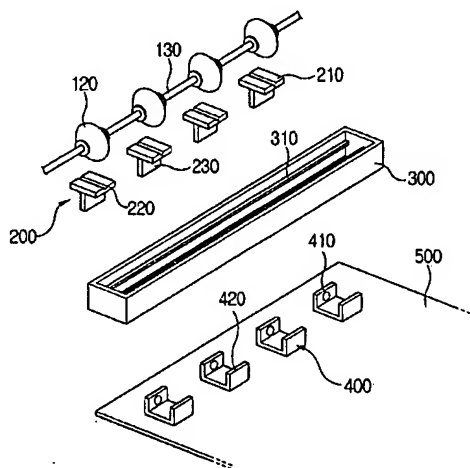
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(54) Title: APPARATUS FOR DETECTING MOVES OF COUNTER FOR ELECTRIC ABACUS



(57) Abstract: Disclosed is an apparatus for detecting the movement of a counter in an electric abacus, in which the position of an abacus counter can be accurately detected regardless of the illuminance of the surroundings. The detecting apparatus includes an abacus frame, a digit rod installed in the frame, a counter movably inserted into the digit rod, a detector device for detecting the position of the counter, an analyzer for converting the output data from the detector device into a digital signal and analyzing an accounting information according to the movement of the counter, and a transmitter for transmitting the analyzed date to a computer. The detector device includes a counter support member closely contacted with the outer circumferential edge of the counter and moving along with the counter, a slider member providing a path such that the counter support member is movable along the path, and a discriminator disposed below the slider member and for detecting a movement of the counter.

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APPARATUS FOR DETECTING MOVES OF COUNTER FOR ELECTRIC
ABACUS

BACKGROUND OF THE INVENTION

5 FIELD OF THE INVENTION

The present invention relates to an apparatus for detecting the movement of a counter in an electric abacus. Particularly, the invention relates to such an apparatus, in which the position of an abacus counter can be accurately detected and determined, regardless of the
10 illuminance of the surroundings.

DESCRIPTION OF THE RELATED ART

An abacus is a type of manual computing device, which
15 can be used to simply carry out addition, subtraction, multiplication, and division. In general, the abacus is comprised of an abacus frame, plural digit rods, and counters moving along the digit rod. The counter consists of an upper and lower counter. A user performs the
20 computation of abacus while moving the counters of each digit rod.

As a computer or an electronic calculator has come into wide use due to the advancement of digital technology, the abacus has given way to them.

However, the abacus is helpful to develop an arithmetic operation ability and a learning ability, and Korean Patent Laid-Open Publication No. 2003-0021208 discloses an electric abacus, which can be used with a computer connected thereto. FIG. 1 is an elevational view of a conventional electric abacus, which is disclosed in the above patent publication. FIG. 2 is a cross-sectional view of the conventional electric abacus in FIG. 1. The electric abacus 10 of FIGS. 1 and 2 is comprised of an abacus frame 11, a digit rod 14 installed in the abacus frame 11, a counter 12 inserted into the digit rod 14 and having a magnet 13 thereinside, a sensor 20 for detecting the movement of the counter 12, an analyzer 15 for analyzing counting information based on the information on the position and movement of the counter from the sensor 20, and an USB connection port 16 for transmitting the analyzed result to a computer (not shown).

In the electric abacus 10, when a user moves the counter 12 placed in each digit rod 14, the magnet 13 inside the counter 12 is moved so that a magnetic field is generated. The sensor 20 disposed in the bottom face of the abacus 10 detects the generated magnetic field, which determines the movement of the counter 12.

The position of a counter 12 detected by the sensor 20 is converted into a digital signal, which is transmitted to the analyzer 15. The analyzer 15 analyzes the counting information according to the movement of the counter 12 and the position of the digit rod 14, and sends the data to a computer through the USB connection port 16.

With the above-described conventional electric abacus, in order to detect the position of a counter, a magnet must be installed inside the counter, or the counter itself must be made of a magnet, and thus it leads to a complexity in the manufacturing process and a reduced efficiency in a mass production.

In addition, the magnet associated with the counter produces an attractive force with each other, so that the counters tend to attract each other, thereby resulting in inconvenience of moving the counters.

Korean Patent Laid-Open Publication No. 2003-0021207 discloses another electric abacus, in which the above sensor 20 is replaced with a light sensor. In this electric abacus, the positions of the counter 12 and the digit rod 14 are determined by detecting whether a light ray is input to the light sensor, i.e., whether a counter 12 is placed above the light sensor.

In the above electric abacus, however, since a light sensor is used as a means for detecting the position of a counter, the upper portion of the abacus must be opened. Therefore, when the intensity of light is higher than the reference value for the determination of the light sensor, the light sensor tends to operate regardless of the position of the counter, thereby leading to a wrong operation of the abacus.

SUMMARY OF THE INVENTION

Therefore, the present invention has been made in order to solve the above problems in the prior art, and it is an object of the present invention to provide an apparatus for detecting the movement of a counter in an electric abacus, in which the position of an abacus counter can be accurately detected and determined without being affected by any external light, and the manufacturing process of an electric abacus can be simplified, thereby improving the production efficiency.

In order to accomplish the above object, according to one aspect of the invention, there is provided an apparatus for detecting the movement of a counter in an electric abacus. The apparatus of the invention comprises a) a

plurality of counter support members each being closely contacted with the outer circumferential edge of the counter, the counter support member moving along with the counter when it moves along a digit rod, b) a slider member providing a path such that the counter support member is movable along the path, and c) a discriminator disposed below the slider member and for determining whether the counter is moved from its original position as the counter support member moves.

10 The counter support member comprises a) an upper frame with the upper face thereof closely contacted with the outer circumferential edge of the counter, and b) a lower frame extended downwardly from the under face of the upper frame by a certain predetermined distance.

15 The upper frame is provided with an inserting groove formed at the center of the upper face thereof, and the counter is inserted to the inserting groove.

The counter support member has at least one of a 'T' shape and an inverted 'H' shape.

20 The slider member has a 'H'-shaped cross-section and comprises a slider plate for providing at both side thereof a longitudinal sliding path wherein the upper face of the slider plate is face-contacted with the under face of the

upper frame, and an open space formed between the slider plates wherein the lower frame can move along the open space.

5 The slider member has an inverted 'U'-shaped cross-section, and has a through-hole formed at a position corresponding to the original position of the counter such that a light ray can pass through the through-hole.

10 The discriminator includes: a) a signal transmitter installed correspondingly to the original position of the counter and for outputting a desired position detection signal, and b) a signal receiver for receiving the position detection signal output from the signal transmitter.

15 The signal transmitter and the signal receiver include respectively a light emitter and a light receiver installed facing each other.

Alternatively, the signal transmitter and the signal receiver may include a light emitter and a light receiver, which are installed side by side and spaced apart from a side face of the lower frame.

20 The light emitter and the light receiver respectively include at least one of an infrared sensor and a supersonic sensor.

The discriminator includes at least one CDS cell

installed below a through-hole of the slider member and for outputting an 'on' or 'off' signal depending on whether a light is introduced through the through-hole.

5 The apparatus for detecting the position of a counter may further comprise: a) an analyzer for analyzing a signal output from the discriminator and a position information according to the movement of the counter; and b) a transmitter for transmitting data output from the analyzer to a computer.

10 The transmitter communicates using a USB.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and advantages of the invention can be more fully understood from the following detailed description taken in conjunction with the accompanying drawings in which:

15

FIG. 1 is an elevational view of a conventional electric abacus;

FIG. 2 is a cross-sectional view of the conventional electric abacus shown in FIG. 1;

20

FIG. 3 shows an elevation of an apparatus for detecting the position of a counter in an electric abacus according to a first embodiment of the invention;

FIG. 4 is an exploded perspective view of the apparatus shown in FIG. 3;

FIG. 5 is a cross-sectional view of the apparatus in FIG. 3 taken along a line B-B;

5 FIG. 6 is a cross-sectional view of the apparatus in FIG. 3 taken along a line C-C;

FIG. 7 is a cross-section showing an apparatus for detecting the position of a counter according to a second embodiment of the invention; and

10 FIG. 8 is a cross-section showing an apparatus for detecting the position of a counter according to a third embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

15 Referring to the accompanying drawings, the preferred embodiments according to the present invention are hereafter described in detail.

(FIRST EMBODIMENT)

20 FIG. 3 shows an elevation of an apparatus for detecting the movement of a counter in an electric abacus according to one embodiment of the invention, in which the electric abacus is generally denoted by a reference numeral 100. Referring to FIG. 3, the electric abacus 100 comprises an

abacus frame 110 having a digit rod 130 installed therein.
A counter 120 is movably inserted into the digit rod 130.
The counter 120 is configured to move along with a counter
support member 200. Below the counter 120 is disposed a
5 slider member 300, which provides a sliding path for the
counter support member 200 to be able to slide therealong.

In addition, the electric abacus 100 is provided with
an analyzer 160 at one side thereof for converting the
signal detected according to the movement of the counter
10 into a digital signal and analyzing the converted digital
signal, and a transmitter 150 for transmitting the analyzed
data from the analyzer 160 to a computer (not shown).
Preferably, the transmitter 150 transmits to and receives
from the computer using a USB.

15 FIG. 4 is an exploded perspective view of the
discriminator in FIG. 3. Referring to FIG. 4, the
apparatus of the invention will be explained in greater
detail. As shown in FIG. 4, the counter 120 is movably
coupled to the digit rod 130, and a counter support member
20 200 is installed correspondingly to each counter 120.

The slider member 300, which is provided below the
counter support member 200, provides a sliding path, in
which the counter support member 200 can slide together

with the counter 120 when it moves. A discriminator 400 for determining the position of a counter by detecting the movement thereof is provided in certain intervals on a printed circuit board (PCB) 500.

5 The counter support member 200 is disposed below the counter 120. The member 200 is comprised of an upper frame 210 closely contacted with the outer circumferential edge of the counter and for supporting the counter 120, and a lower frame 230 extended downwardly from the upper frame 210 by a certain distance. Preferably, the counter support member 200 has a 'T' shape.

10 The upper frame 210 is formed of a rectangular plate, and has an inserting groove 220 at the center of the upper face thereof, to which the outer circumferential edge of the counter 120 is inserted and closely contacted with the upper frame 210. The counter 120 closely inserted to the inserting groove 220 is moved along with the upper frame 210, i.e., the counter support member 200, when it moves along the digit rod 130.

20 The slider member 300 is disposed below the counter support member 200. The slider member 300 is formed of a rectangular frame, which is opened to the upper and lower side. A slider plate 310 is provided at both inner sides

of the slider member 300 in a longitudinal direction and facing each other, thereby providing a sliding path where the counter support member 200 slidably moves.

5 The upper face of the slider plate 310 is face-contacted with the bottom face of the upper frame 210 of the counter support member 200 to thereby provide a sliding path for the counter support member 200 when it moves. The lower frame 230 of the counter support member 200 moves along the open path formed between the slider plates 310.

10 The discriminator 400 is disposed below the slider member 300 and installed on the printed circuit board 500 in certain intervals. The discriminator 400 is provided with a transmitter 410 and a receiver 420 disposed in the inner sides thereof and facing each other, such that a position detection signal from the signal transmitter 410
15 can be transmitted to the receiver 420. The transmitter and receiver may be fixed to the discriminator 400 by means of soldering.

20 The discriminator 400 may be formed of an inverted 'U'-shaped member, in which the signal transmitter and receiver 410, 420 are installed facing each other, and the inverted 'U'-shaped member may be installed in the PCB 500.

The signal transmitter 410 and the signal receiver 420

comprise at least one of an infrared sensor and a ultrasonic sensor. The receiver 420 is preferred to be an infrared sensor detecting infrared rays.

If the receiver 420 detects the position detection
5 signal, for example, an infrared ray, output from the signal transmitter 410, it generates an 'on' signal (a high signal), otherwise an 'off' signal (a low signal). The generated signal is transmitted to the analyzer 160 via a circuit established in the printed circuit board 500.

10 FIG. 5 shows a cross-sectional view of the apparatus in FIG. 3 taken along the line B-B, and FIG. 6 shows a cross-section of the apparatus in FIG. 3 taken along the line C-C. Referring to FIGS. 5 and 6, the operation of the apparatus of the invention will be explained below.

15 When the user moves the counter 120 of the electric abacus 100, the counter support member 200, to which the outer circumferential edge of the counter 120 is tightly contacted, is moved together along the slider plate 310 of the slider member 300.

20 As the counter support member 200 moves, the lower frame 230 integrally formed below the upper frame 210 travels between the transmitter 410 and the receiver 420 such that the receiver 420 can receive the position

detection signal or can not do so.

For example, when the lower frame 230 is placed between the transmitter 410 and the receiver 420, the receiver 420 outputs an 'off' signal (a low signal). When the lower frame 230 is departed from between the transmitter 410 and the receiver 420 to a desired position, the receiver 420 receives the position detection signal output from the transmitter 410 and outputs an 'on' signal (a high signal), thereby enabling to determine whether or not the counter is moved.

Next, the movement of the counter and the position detection will be described below. When a first counter 120a is moved to the next position from its original place, and a second counter 120b is moved to the position of the first counter 120a from its original place, the positions of the counters 120a, 120b are detected as follows.

Where the first and second counters 120a, 120b both are placed in their original position, a first and second discriminators 400a, 400b both output an 'off' signal, i.e., remain in the 'zero' state.

If the user moves the first counter 120a, the counter support member 200 closely contacted with the first counter 120a moves and thus the first lower frame 230a is departed

from the first discriminator 400a, so the first discriminator 400a becomes an 'on' state.

After the first counter 120a moves, when the second counter 400b is moved to the position of the first counter, i.e., the first discriminator 400a, the first discriminator 400a comes into an 'off' state, and the second discriminator 400b is switched to an 'on' state since the lower frame 230b of the second counter 120b is departed from the second discriminator 400b.

Therefore, as the counters 120a, 120b move, their position information can be accurately detected, along with those of the digit rods, and the discriminator of the invention can be operated, without being affected by the external light.

(SECOND EMBODIMENT)

FIG. 7 is a cross-section showing an apparatus for detecting the movement of a counter according to a second embodiment of the invention. The constructions of the counter support member 200 and the slider member 300 are identical to those of the first embodiment, and their details will be omitted.

In FIG. 7, the second embodiment differs from the previous one in that the transmitter 410 and the receiver

420 for detecting the lower frame 230 of the counter support member 200 are disposed in the same plane. That is, when the signal output from the signal transmitter 410 is reflected on the lower frame 230 of the counter support member 200 and received by the signal receiver 420, the position of the counter 120 is detected by determining that the counter support member 200 is placed in the current position.

Referring back to FIG. 6, the operation of the apparatus of the second embodiment will be described below.

When a first counter 120a is moved to the next position from its original place, and a second counter 120b is moved to the position of the first counter 120a from its original place, the positions of the counters 120a, 120b are detected as follows.

Where the first and second counters 120a, 120b both are placed in their original position, a first and second discriminators 400a, 400b both output an 'off' signal. I.e., a position detection signal output from the signal transmitter spaced-apart from one face of the first lower frame 230a is reflected on the first lower frame 230a and received by the signal receiver so that an 'off' signal is output.

When the user moves the first counter 120a, the counter support member 200 closely contacted with the first counter 120a moves and thus the first lower frame 230a is departed from the first discriminator 400a, so the first discriminator 400a is switched to an 'on' state from the 'off' state.

After the first counter 120a moves, if the second counter 400b is moved to the position of the first counter, i.e., the first discriminator 400a, the first discriminator 400a comes into an 'off' state from an 'on' state, and the second discriminator 400b is switched to an 'on' state from an 'off' state since the lower frame 230b of the second counter 120b is departed from the second discriminator 400b.

(THIRD EMBODIMENT)

FIG. 8 is a cross-section showing an apparatus for detecting the movement of a counter according to a third embodiment of the invention. Referring to FIG. 8, the counter 120 is movably coupled to the digit rod 130, and the counter support member 200 is installed correspondingly to each counter 120. The slider member 300 provides a sliding path, along which the counter support member 200 can slide together with the counter 120 when it moves. A CDS (Cadmium Sulfide) cell 430 for detecting the movement of

the counter support member 200 is installed, in certain intervals, on the printed circuit board (PCB) 500 by means of soldering.

5 The counter support member 200 has a '凹' shape, and is comprised of the upper frame 210 closed contacted with the counter 120, and a guide 240 for supporting the counter support member 200 so as to be able to slide along a desired path.

10 The upper frame 210 is formed of a rectangular plate, and has an inserting groove 220 at the center of the upper face thereof, to which the outer circumferential edge of the counter 120 is inserted and closely contacted to the upper frame 210.

15 The guide 240 is extended downwardly from both side edges of the upper frame 210, and supports the counter support member 200 such that it can slide along the sliding path.

20 The slider member 300 is disposed below the counter support member 200, and provides a sliding path, along which the counter support member 200 can slidably move. The slide member 300 is provided with a through-hole formed at the corresponding position to each counter 120.

The through-hole 320 serves as a light path leading to

the CDS cell 430 and is opened or closed depending on the movement of the upper frame 210.

The CDS cell 430 is installed in certain intervals on the printed circuit board 500 and the position of each CDS
5 cell 430 is aligned with that of each corresponding through-hole 320 disposed thereabove and formed in the slider member 300. The light passing through the through-hole 320 can be detected by the CDS cell 430, which sends
10 or an 'off' signal (a low signal) when not detected, to an analyzer (not shown) via a circuit established on the printed circuit board 500.

Therefore, if the counter 120 moves, then the counter support member 200 also moves, so that the movement of the
15 counter can be determined by detecting whether or not the light is introduced through the through-hole 320 formed in the slider member 300.

Industrial Applicability

20 As described above, according to the present invention, the position of an abacus counter can be accurately detected and determined without being affected by any external light.

In addition, according to the invention, the

manufacturing process of an electric abacus can be simplified, thereby improving the production efficiency.

While the present invention has been described with reference to several preferred embodiments, the description
5 is illustrative of the invention and is not to be construed as limiting the invention. Various modifications and variations may occur to those skilled in the art without departing from the scope and spirit of the invention as defined by the appended claims.

What is claimed is:

1. An apparatus for detecting a movement of a counter in an electric abacus, the apparatus comprising:

5 a) a plurality of counter support members each being closely contacted with the outer circumferential edge of the counter, the counter support member being capable of moving along with the counter when it moves along a digit rod;

10 b) a slider member providing a path such that the counter support member is movable along the path; and

c) a discriminator disposed below the slider member and for determining whether the counter is moved from its original position as the counter support member moves.

15 2. An apparatus according to claim 1, wherein the counter support member comprises:

a) an upper frame with the upper face thereof closely contacted with the outer circumferential edge of the counter; and

20 b) a lower frame extended downwardly from the under face of the upper frame by a certain predetermined distance.

3. An apparatus according to claim 2, wherein the upper

frame is provided with an inserting groove formed at the center of the upper face thereof, the counter being inserted to the inserting groove.

5 4. An apparatus according to claim 2, wherein the counter support member has at least one of a 'T' shape and an inverted '凹' shape.

10 5. An apparatus according to claim 1, wherein the slider member has a 'H'-shaped cross-section and comprises a slider plate for providing at both side thereof a longitudinal sliding path, the upper face of the slider plate being face-contacted with the under face of the upper frame, and an open space formed between the slider plates,
15 the lower frame being capable of moving along the open space.

20 6. An apparatus according to claim 1, wherein the slider member has an inverted '凹'-shaped cross-section, and has a through-hole formed at a position corresponding to the original position of the counter, a light ray being capable of passing through the through-hole.

7. An apparatus according to claim 1, wherein the discriminator includes:

a) a transmitter installed correspondingly to the original position of the counter and for outputting a desired position detection signal; and

b) a receiver for receiving the position detection signal output from the signal transmitter.

8. An apparatus according to claim 7, wherein the signal transmitter and the signal receiver include respectively a light emitter and a light receiver installed facing each other.

9. An apparatus according to claim 7, wherein the signal transmitter and the signal receiver include a light emitter and a light receiver, which are installed side by side and spaced apart from a side face of the lower frame.

10. An apparatus according to claim 8 or 9, wherein the light emitter and the light receiver respectively include at least one of an infrared sensor and a ultrasonic sensor.

11. An apparatus according to claim 1, wherein the discriminator includes at least one CDS cell installed below a through-hole of the slider member and for outputting an 'on' or 'off' signal depending on whether a light is introduced through the through-hole.

12. An apparatus according to claim 1, further comprising:

a) an analyzer for analyzing a signal output from the discriminator and a position information according to the movement of the counter; and

b) a transmitter for transmitting data output from the analyzer to a computer.

13. An apparatus according to claim 12, wherein the transmitter communicates using a USB.

FIG. 1

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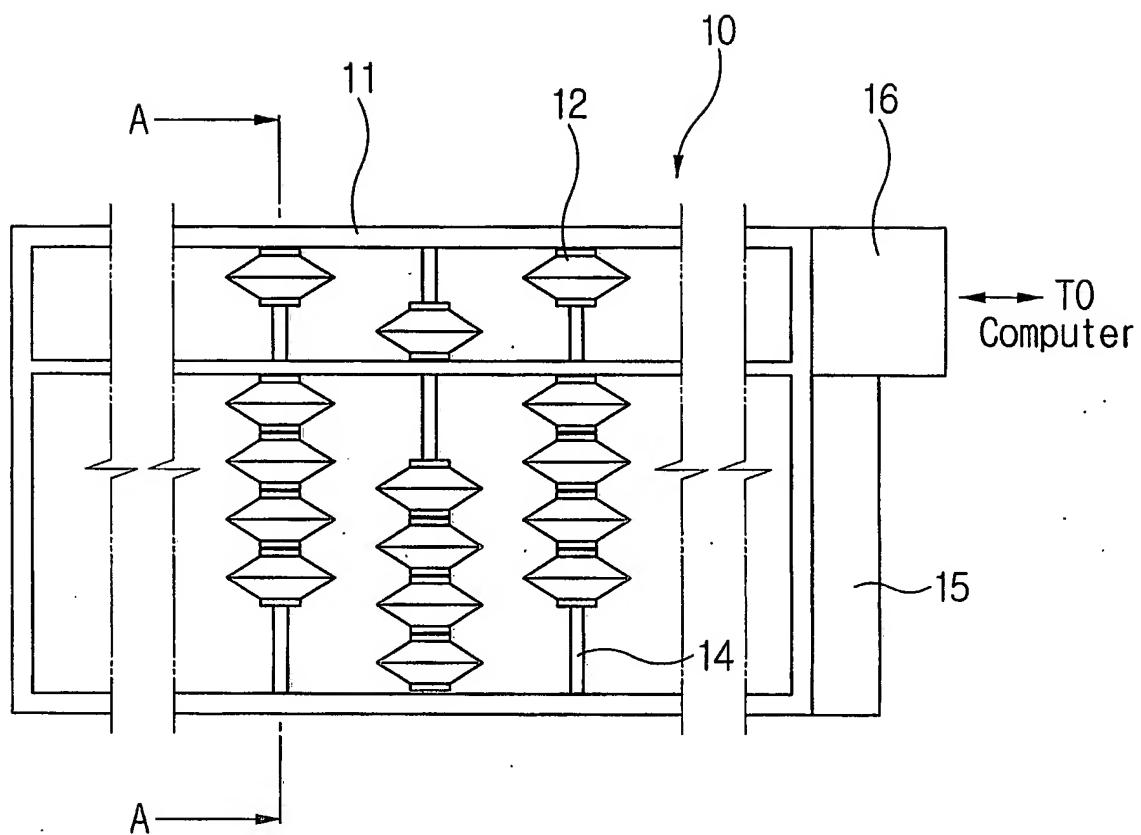


FIG. 2

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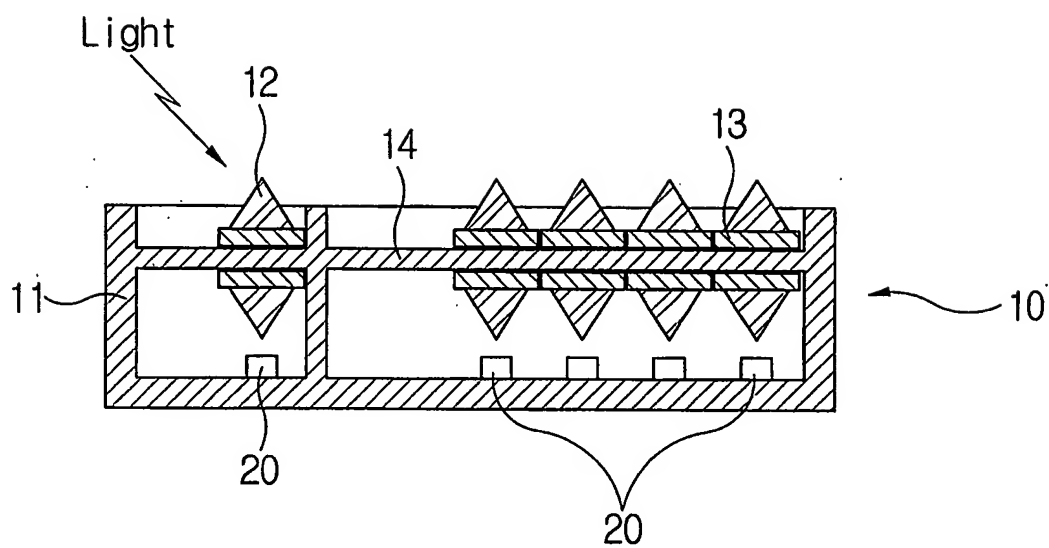


FIG. 3

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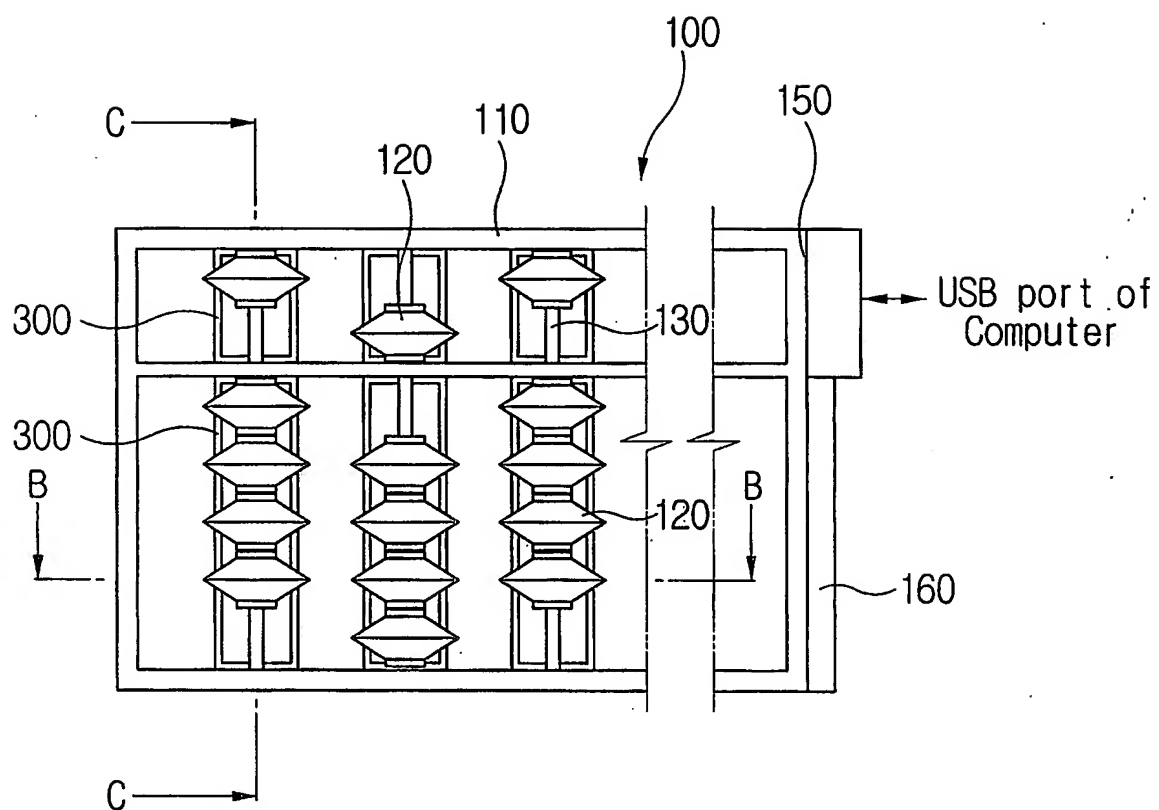


FIG. 4

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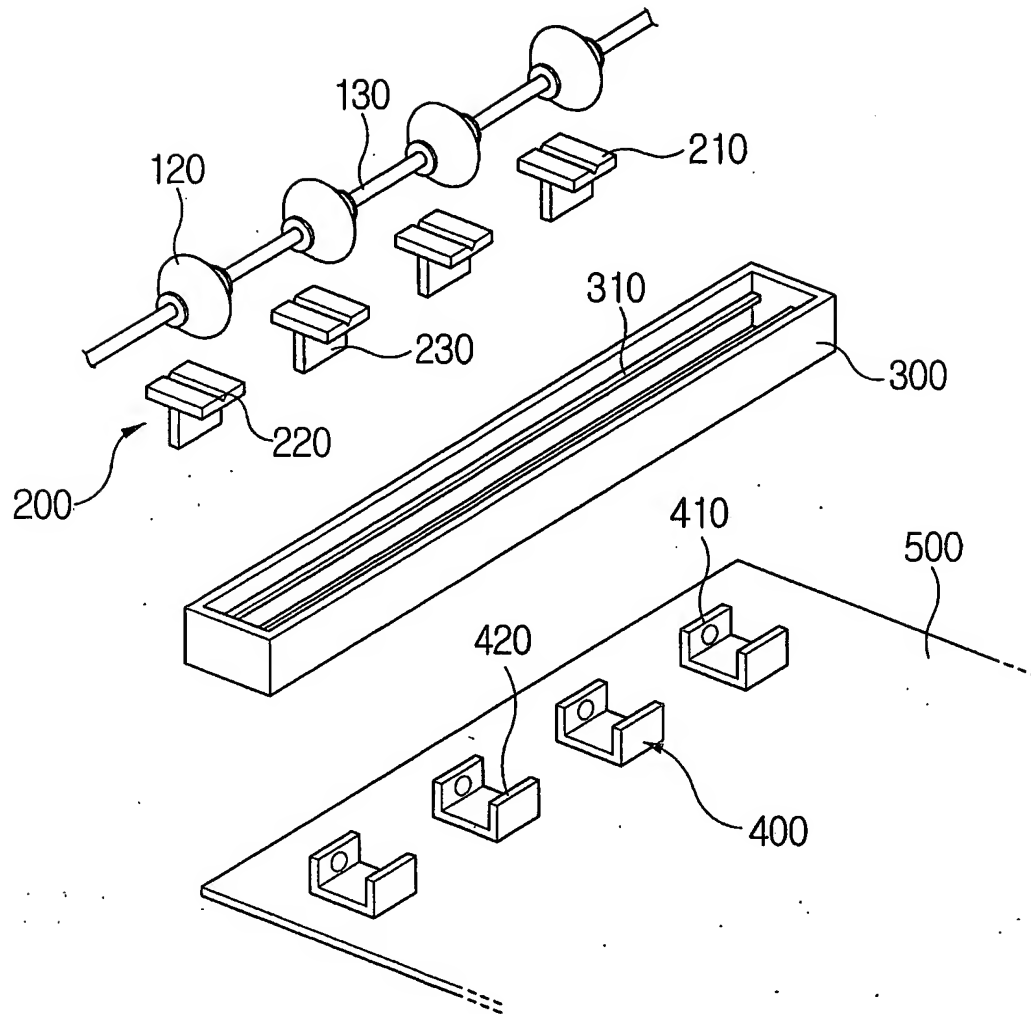


FIG. 5

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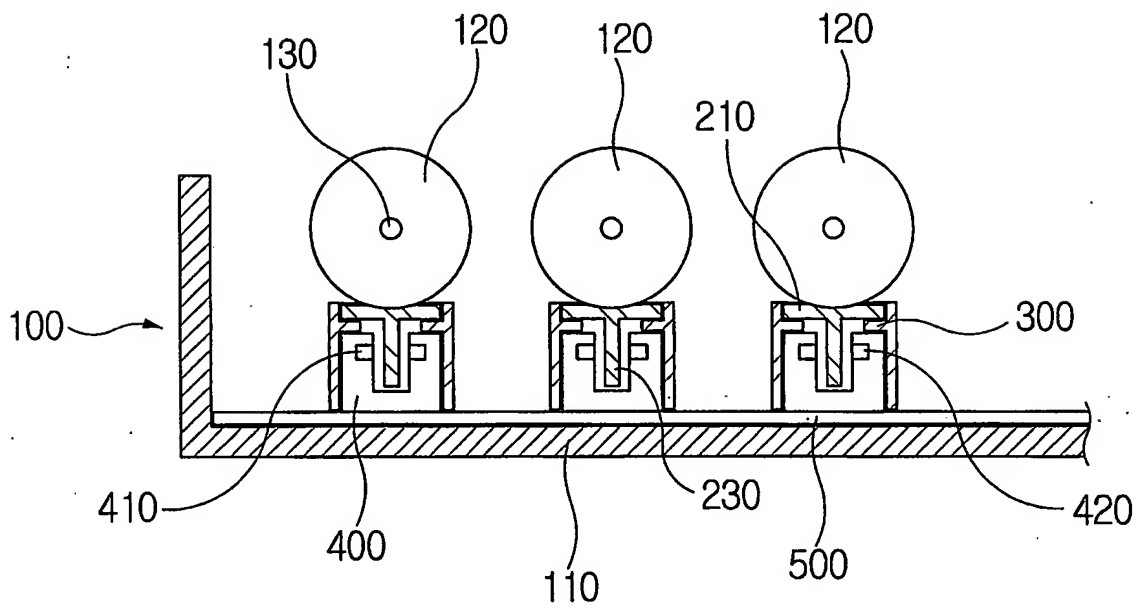


FIG. 6

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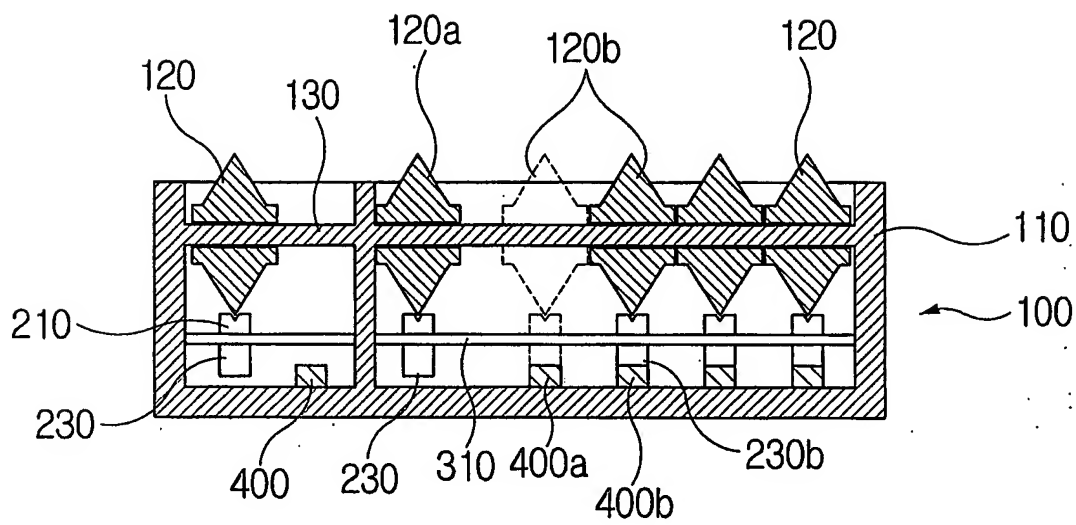


FIG. 7

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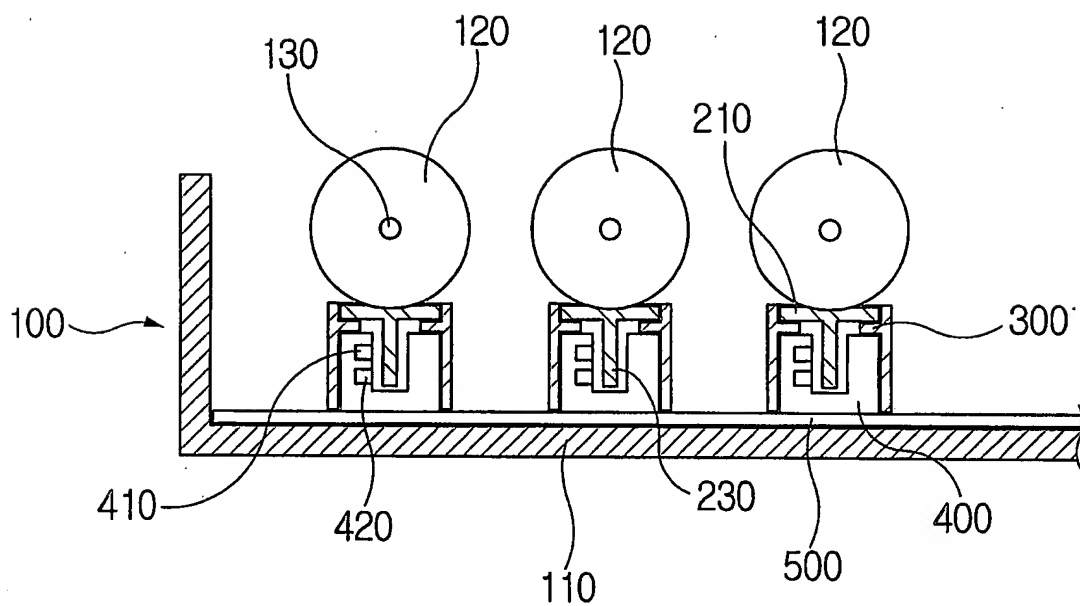
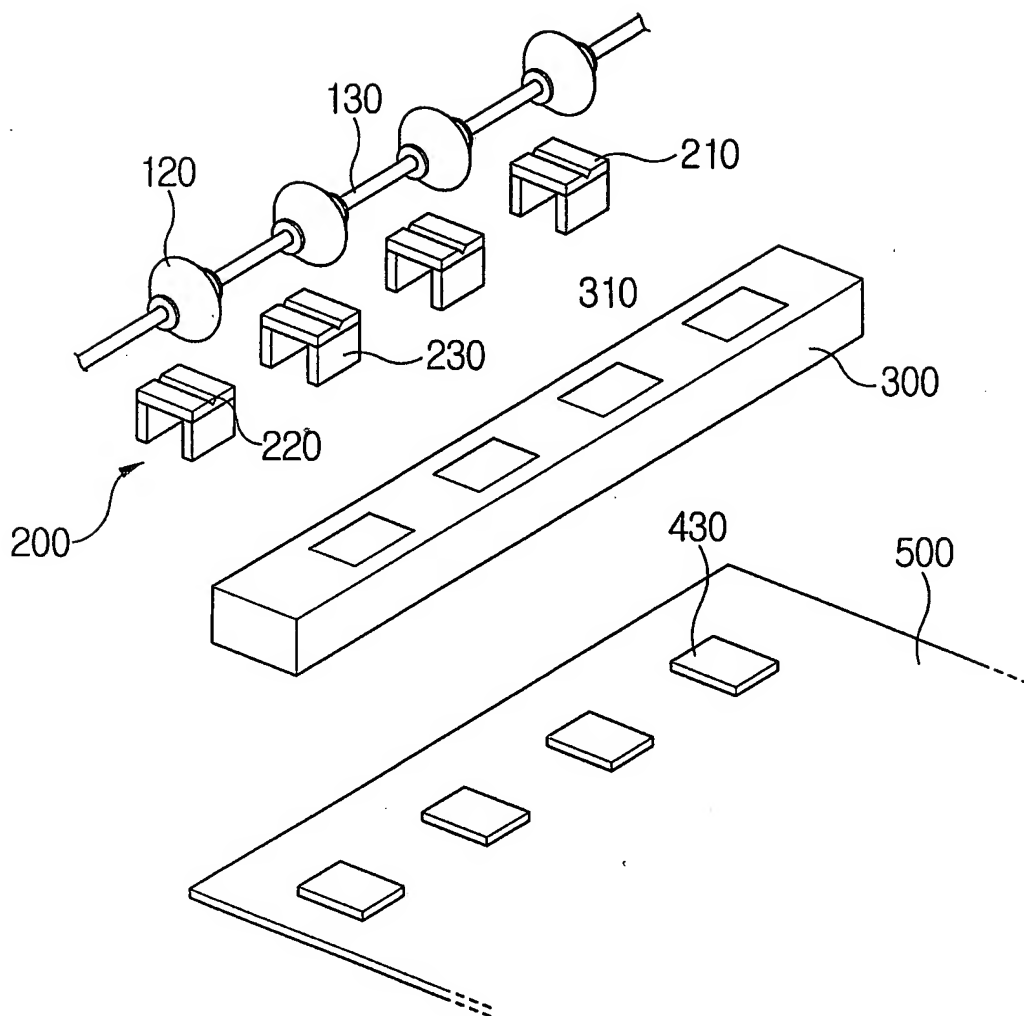


FIG. 8

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2004/001762

A. CLASSIFICATION OF SUBJECT MATTER**IPC7 G06F 3/023**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
KR: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS "abacus", "bead", "light", "sensor"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	KR 2003-0021208 A (Eduserve Co.) 12 March 2003	1-5, 7-8, 12-13 6, 9-11
X A	JP 11-119896 A (HIRAI YOSHIHIRO) 30 April 1999	1-5, 7-8, 12-13 6, 9-11
X A	KR 2003-0043898 A (Eduserve Co.) 2 June 2003	1-5, 7-8, 12-13 6, 9-11
X A	KR 2003-0021207 A (Eduserve Co.) 12 March 2003	1-5, 7-8, 12-13 6, 9-11
X	JP 2-127712 A (NEC Corp) 16 May 1990 1-13 —/—	1-13


☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
21 OCTOBER 2004 (21.10.2004)

Date of mailing of the international search report
21 OCTOBER 2004 (21.10.2004)

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